

FORM PTO-1390  
(REV. 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371248/087

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

**09/868272**

INTERNATIONAL APPLICATION NO.

**PCT/IL99/00684**

INTERNATIONAL FILING DATE

**15 Dec. 1999**

PRIORITY DATE CLAIMED

**15 Dec. 1998; 10 Feb. 1999; 15  
April 1999; 17 Oct. 1999**

TITLE OF INVENTION

**Packaging for Metal-Air Batteries with Hydrogen Release Valve****22249**

APPLICANT(S) FOR DO/EO/US

**Givon, Menachem**

PATENT TRADEMARK OFFICE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is attached hereto (required only if not communicated by the International Bureau)
  - b. ☐ has been communicated by the International Bureau
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a. ☐ is attached hereto.
  - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4)
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 – 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information:

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) <b>09/868272</b>		INTERNATIONAL APPLICATION NO. <b>PCT/IL99/00684</b>		ATTORNEY'S DOCKET NUMBER <b>248/087</b>	
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21. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1) – (5)):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... <b>\$1000.00</b> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$860.00</b> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$710.00</b> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$690.00</b> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b> <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				<b>CALCULATIONS PTO USE ONLY</b>	
				<b>\$1000</b>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				<b>\$130</b>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	20 - 20 =	0	x <b>\$18.00</b>	\$	
Independent claims	4 - 3 =	1	x <b>\$80.00</b>	\$80	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ <b>\$270.00</b>	\$
<b>TOTAL OF ABOVE CALCULATIONS =</b>				<b>\$1210</b>	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				+ <b>\$605</b>	
<b>SUBTOTAL =</b>				<b>\$605</b>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
<b>TOTAL NATIONAL FEE =</b>				<b>\$605</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property				\$	
<b>TOTAL FEES ENCLOSED =</b>				<b>\$</b>	
				<b>Amount to be refunded:</b>	\$
				<b>charged:</b>	<b>\$605</b>

a. ☐ A check in the amount of \$ \_\_\_\_\_ to cover the above fees is enclosed.

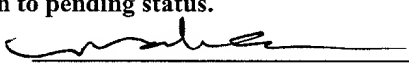
b. ☒ Please charge my Deposit Account No. 12-2475 in the amount of \$605 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-2475. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:  
 LYON & LYON  
 633 WEST FIFTH STREET, SUITE 4700  
 LOS ANGELES, CALIFORNIA 90071-2066 — (213) 489-1600  
 ATTY NAME \_\_\_\_\_

  
 SIGNATURE  
 NAME Mark Catan  
 REGISTRATION NUMBER 38,720 \_\_\_\_\_

PACKAGING FOR METAL-AIR BATTERIES WITH  
HYDROGEN RELEASE VALVE

Cross Reference to Related Applications

5 Priority is claimed to the following United States Patent Applications: serial number 60/161,767 filed on October 27, 1999, serial number 60/112,292 filed on December 15, 1998, serial number 60/129,666 filed on April 15, 1999, serial number 09/293,927 filed on April 15, 1999, and serial number 60/119,568 filed on February 10, 1999.

Field of the Invention

10 The present invention relates to packaging for storing metal-air battery cells and devices that contain metal-air battery cells. More particularly, the present invention relates to a packaging that substantially prevents water and other debris from entering the packaging and permits the release of hydrogen out of the packaging. The packaging also restricts the ingress  
15 of oxygen into the packaging.

Background of the Invention

20 Most high-drain portable electronic devices are powered by secondary or rechargeable batteries. Examples of such high-drain devices are cellular telephones, notebook computers, camcorders, and cordless hand-tools. The reason primary batteries are unattractive in such applications is that the life-span of a typical primary or single-use batteries is so short, and the cost so high, that they ultimately prove too costly for long-term use. In addition, their weight alone would discourage a person from carrying enough primary batteries for a long-term operation of the device. For example, a cellular telephone with alkaline batteries would last  
25 about as long as a single charge of a nickel-metal-hydride battery, but in the long term, cost far more per unit energy. A nickel-metal hydride battery, though initially expensive, costs only pennies to recharge.

30 New primary battery technologies have emerged that have, in principle at least, the ability to offer sufficient energy and power at a sufficiently low cost to make these batteries attractive for high-drain portable devices. One such technology is metal-air batteries, for example zinc-air batteries. In a zinc-air battery, one of the electrodes of the battery uses oxygen that can be supplied by ambient oxygen. Since oxygen is available everywhere, a zinc-air battery need house only one consumable electrode. Because of this, the energy

capacity per unit weight is magnified greatly. Unfortunately, the intrinsic benefits of electrochemical cells that use air as an electrode are attended by some serious technical problems.

One problem concerns the metal-air batteries needed for oxygen. Although zinc-air batteries have high energy densities, they are moderately low on power. To increase their power, large amounts of oxygen must be supplied. Increasing the batteries' access to oxygen is sometimes accomplished by designing the metal-air batteries or the housings that encase one or more metal-air batteries with relatively large and/or numerous openings. However, increasing the size and number of openings may also increase the likelihood that water and other debris may contact or enter the metal-air batteries. Increasing the size may also cause water vapor to leave the batteries, resulting in battery desiccation. Both of these occurrences may increase the likelihood that the battery will malfunction.

However, a metal-air battery's exposure to oxygen is preferable when the battery supplies energy, such as when a device connected to the battery is turned on. During non-use times, it is preferable for the battery to cut off from outside contaminants, as well as oxygen and carbon dioxide.

Another problem concerns the production of hydrogen. During operation and during storage of some metal-air batteries, the batteries may produce hydrogen due to the natural corrosion of a zinc oxide. During normal operation, the production of hydrogen can be released to the outside ambient air through the same openings by which oxygen and other gases enter the batteries. However, in the storage context, the competing interest of storing the batteries in an air tight enclosure to limit the batteries' exposure to carbon dioxide, oxygen, water and other debris may counter the need to release hydrogen from the enclosure. Enclosing the batteries in an air tight packaging may prevent the hydrogen from leaving the packaging and cause the packaging to expand and possibly burst.

#### Summary of the Invention

The present invention provides a package for encasing an electrochemical device requiring an ambient gas. The package has an enclosure capable of encasing the electrochemical device that is substantially impermeable to oxygen so that the ingress of oxygen into the packaging is restricted. Restricting access to oxygen may increase battery life. The packaging also permits the egress of hydrogen out of the packaging, which can build up during the storage of metal-air batteries. The package is made of a substantially air-

impermeable material that is sealed to enclose the device. A hole is formed in the packaging and that hole is covered with a one way valve sticker or other material that can be adhered to the packaging to restrict the flow of gases, water and other debris through the hole and into the packaging. The sticker also permits the diffusion of hydrogen gases out of the packaging so as to prevent the packaging from expanding to a volume that may cause the packaging to rupture. The material behaves as a one way valve for the release of gases out of the packaging.

The invention will be described in connection with certain preferred embodiments, with reference to the following illustrative figures so that it may be more fully understood.

With reference to the figures, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice.

#### Brief Description of the Drawings

FIG. 1 is a perspective view of a prismatic metal-air battery cell.

FIG. 2 is a set of illustrations from front and side of an embodiment of a packaging configuration.

#### Detailed Description of the Preferred Embodiment

Referring now to the drawings, as shown in FIG. 1, a metal-air battery cell 101 has a casing with holes 105 for the egress and ingress of air through the casing. The ingress of air is a necessary operation for the proper functioning of a metal-air battery cell 101. One or a multiple of the battery cells 101 can electrically connected and housed in a battery casing to form a battery pack.

Referring to FIG. 2, a gas impermeable bag 500 encloses a battery pack 520 holding at least metal-air battery cell. The bag 500 has a hole 505. The hole 505 is covered by a one way valve 510 to prevent the egress or ingress of air except through the one way valve 510. The one way valve 510 permits hydrogen gas to escape from the enclosure of the bag 500.

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Hydrogen gas may be produced when the zinc anode of the metal-air battery cell corrodes. This hydrogen gas should be released from the bag to prevent the bag from expanding considerably and possibly causing the bag 500 to rupture. An example of a suitable one way valve is the product V45 Aromafine, which is made by Bosch® and is typically used for storing coffee. This one way valve 510 permits the release of hydrogen out of the bag 500 and prevents the flow of oxygen into the bag 500.

The gas impermeable bag 500 can be made of a flexible plastic, a foil plastic laminate, or any other air impermeable material that protects the battery pack 520 from the outside environment. The one way valve 510 is attached to the bag 500 and covers the hole 505. The valve 510 is adhered to the bag through an adhesive, by thermally bonding the valve 510 to the bag 500, or by any other method that will form an air tight seal with the bag 500.

In the alternative, the one way valve 510 can be replaced with an air permeable sticker or alternative air permeable material. The air permeable sticker permits hydrogen gas to diffuse out of the bag 500. The sticker also prevents water and other debris from entering the bag.

The following examples are descriptions of the use of the present invention. These examples are not meant to limit the scope of the invention, but are merely examples of specific embodiments.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied in other specific forms without departing from essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

## CLAIMS

1. A storage package for a metal-air battery which is completely sealed against leakage of electrolyte therefrom, said storage package being for further encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package comprising:

a gas impermeable enclosure with a valve communicating an interior of said enclosure with an outside of said enclosure; and wherein said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

2. A package as in claim 1 wherein said valve is a one-way valve.

3. A package as in claim 2 wherein said enclosure is formed of a flexible plastic.

4. A package as in claim 2 wherein said enclosure is formed of a foil or plastic laminate.

5. A package as in claim 2 wherein said valve prevents the ingress of fluid into said enclosure.

6. A package as in claim 2 wherein said valve prevents a pressure buildup in said enclosure.

7. A package as in claim 2 wherein said enclosure prevents the ingress of oxygen into said enclosure.

8. A package as in claim 1 wherein said enclosure is formed of a flexible plastic.

9. A package as in claim 1 wherein said enclosure is formed of a foil or plastic laminate.

10. A package as in claim 1 wherein said valve prevents the ingress of fluid into said enclosure.

11. A package as in claim 1 wherein said valve prevents a pressure buildup in said enclosure.

12. A package as in claim 1 wherein said enclosure prevents an ingress of oxygen into said enclosure.

13. A storage package for a metal-air battery which is completely sealed against leakage of electrolyte therefrom, said storage package being for further

encapsulating said sealed battery to substantially prevent ingress of oxygen into said battery, said storage package comprising:

a substantially gas impermeable enclosure with an air permeable portion communicating an interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

14.A package as in claim 12 wherein said air permeable portion is an air permeable sticker attached to said enclosure.

15.A package as in claim 12 wherein said enclosure prevent the ingress of fluid into said enclosure.

16.A package as in claim 12 wherein said valve prevents a pressure buildup in said enclosure.

17. A package as in claim 12 wherein said enclosure is formed of a flexible plastic.

18. A package as in claim 12 wherein said enclosure is formed of a foil or plastic laminate.

19. A metal-air battery characterized in that it comprises a storage package encapsulating the battery, the storage package comprising:

a gas impermeable enclosure preventing ingress of gases to an interior of the enclosure and having a valve communicating the interior of said enclosure with an outside of said enclosure; and wherein

said valve is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.

20. A metal-air battery characterized in that it comprises a storage package encapsulating the battery, the storage package comprising:

a substantially gas impermeable enclosure preventing ingress of gases to an interior of the enclosure and having an air permeable portion communicating the interior of said enclosure with an outside of said enclosure; and wherein

said air permeable portion is effective to permit the egress of hydrogen gas from said inside to said outside of said enclosure.



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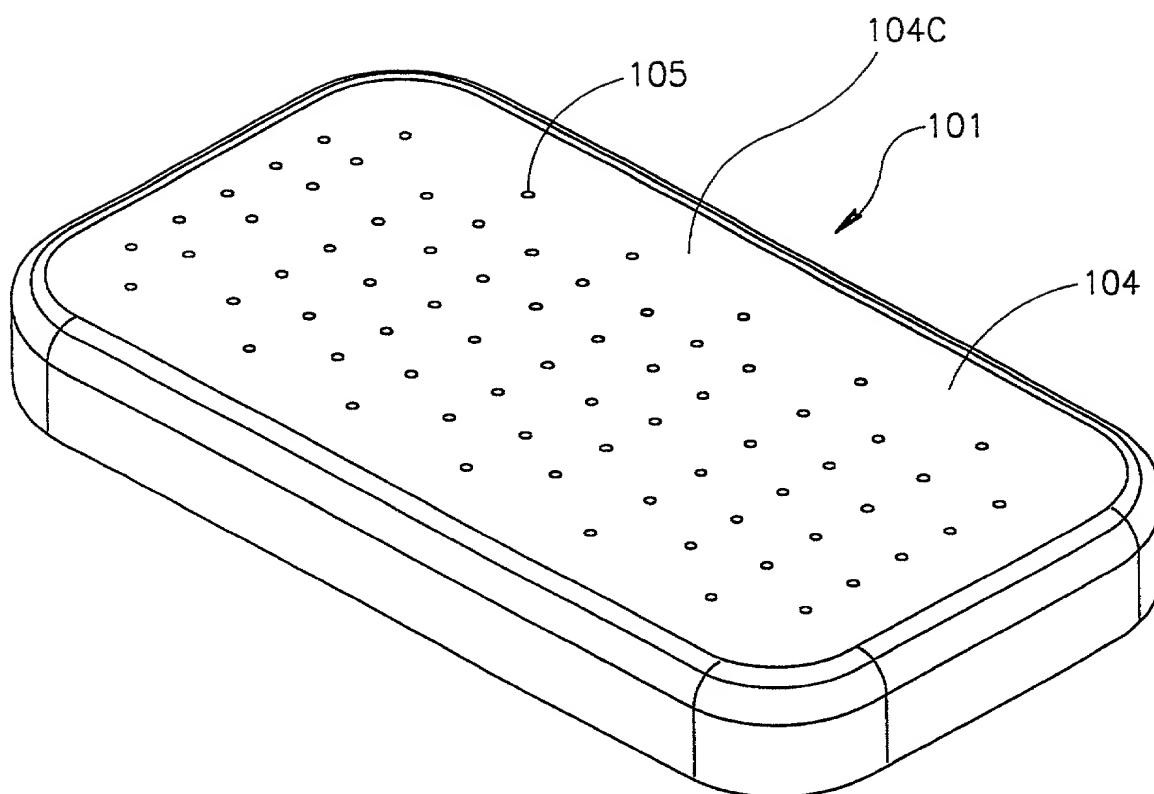


FIG.1

2/2

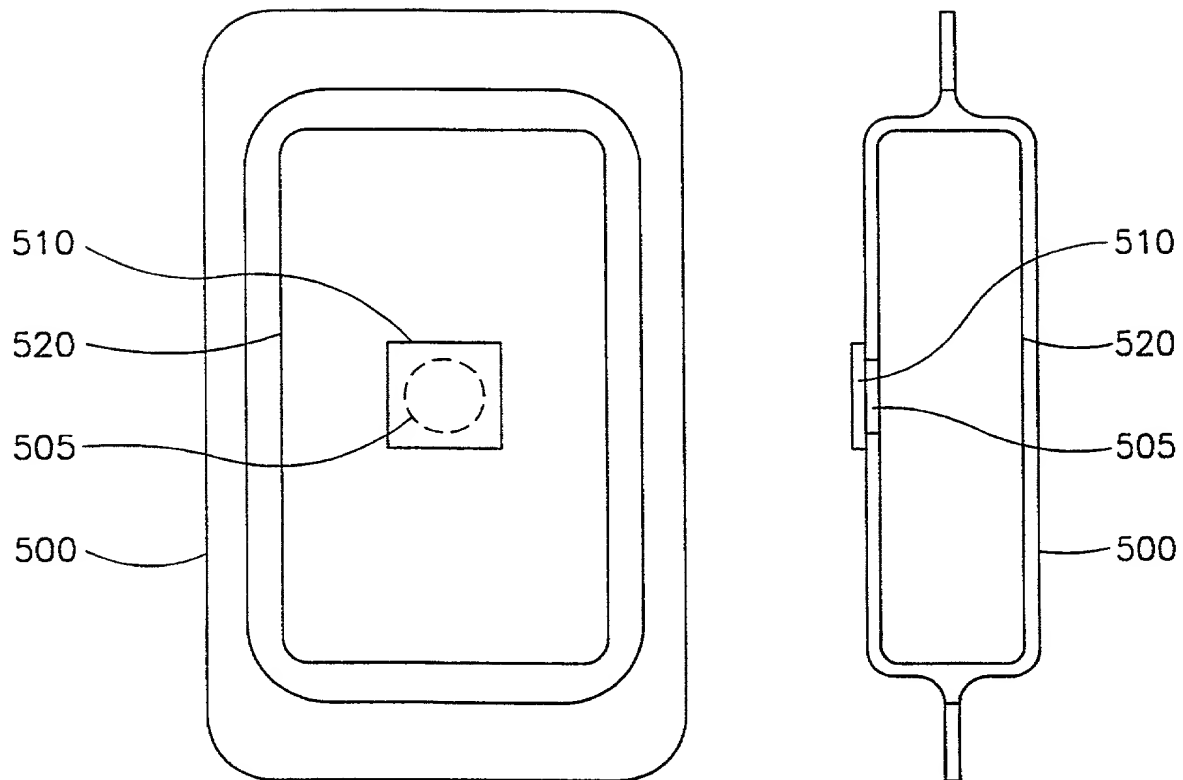


FIG.2

**UTILITY DECLARATION  
AND POWER OF ATTORNEY  
Utility Application**

As below named inventors, we hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled PACKAGING FOR METAL-AIR BATTERIES WITH HYDROGEN RELEASE VALVE the specification of which

(Check One)

☐  
☒

is attached hereto OR

was filed on 06/15/01 as United States Application Serial No. 09/868,272 or PCT International Application No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Date of Filing	Priority Claimed	
			Yes	No
PCT/IL99/00684	PCT	12/15/99	Yes	

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date	Status-Patented, Pending or Abandoned

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint as my attorneys and/or agents, with full power of substitution and revocation, to prosecute this application and transact all business in the United States Patent and Trademark Office, and in countries other than the United States, and to do all things necessary or appropriate therefor before any competent International Authorities in connection with any international patent application(s) corresponding to the above-identified invention application, all of the registered practitioners identified by Customer Number 22249:



22249

PATENT TRADEMARK OFFICE

LYON & LYON LLP  
Suite 4700  
633 W Fifth Street  
Los Angeles, CA 90071  
(213) 489-1600

Please direct all inquiries to Mark A. Catan, at the above Customer Number.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Send Correspondence to: Mark A. Catan, Esq.	LYON & LYON LLP 633 W Fifth St., Suite 4700 Los Angeles, CA 90071	Direct Telephone calls to: Mark A. Catan, Esq.. (914) 681-8851
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	FULL NAME OF INVENTOR	FIRST Name MENACHEM	MIDDLE Initial	LAST Name GIVON
201	RESIDENCE & CITIZENSHIP	City HANEDEV ILX	State or Foreign Country ISRAEL	Country of Citizenship ISRAEL
	POST OFFICE ADDRESS	Kibutz Shoval	City HAVEDEV	State or Country ISRAEL
			Zip Code	
	FULL NAME OF INVENTOR	FIRST Name	MIDDLE Initial	LAST Name
202	RESIDENCE & CITIZENSHIP	City	State or Foreign Country	Country of Citizenship
	POST OFFICE ADDRESS		City	State or Country
			Zip Code	
	FULL NAME OF INVENTOR	FIRST Name	MIDDLE Initial	LAST Name
203	RESIDENCE & CITIZENSHIP	City	State or Foreign Country	Country of Citizenship
	POST OFFICE ADDRESS		City	State or Country

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature of Inventor <i>M. G. Lyon</i>	201	Signature of Inventor	205
Date 1/11/02		Date	
Signature of Inventor	202	Signature of Inventor	206
Date		Date	
Signature of Inventor	203	Signature of Inventor	207
Date		Date	
Signature of Inventor	204	Signature of Inventor	208
Date		Date	

(Signatures should conform to names as presented at 201 et seq. above.)